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Right ventricular lead in cardiac resynchronization therapy: what is the most electrically favorable stimulation site?

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Introduction: The most recent studies in cardiac resynchronization therapy (CRT) have been focused on attempts to improve response rate, such as the determination of the optimal placement of the left ventricular (LV) lead. The position of the LV lead guided by the site of latest electrical delay (ED), seems to be a promising strategy. The same strategy may be useful in assessing the ideal positioning of right ventricular (RV) lead in CRT.
Purpose: To determine the most favorable position of the RV lead (septal versus apical) in CRT, by measuring the ED of the LV poles during septal or apical RV pacing in patients with triple-site CRT (TRIV).
Methods: A single-center prospective study of consecutive patients (Oct. 2014 to Oct. 2017) submited to CRT device implantation (Quadra Allure MPTM, which allows post-implantation ED measurement) in TRIV mode - with a quadripolar lead in the LV, a RV lead positioned at the septum and a RV lead at the apex. In the follow-up, the lead position was confirmed and determined by fluoroscopic evaluation (anterior, lateral and postero-lateral in the short axis and basal, mid and apical on the long axis). The ED was measured at the 4-pole LV lead, during apical and septal RV pacing and the relation between the ED and lead position was evaluated.
Results: Twenty two patients were included: 82% male, median age 78 years; 50% implanted CRT with defibrillator; 27% had ischemic heart disease and 73% non-ischemic etiology; all patients had permanent atrial fibrillation and the QRS duration was of 176±29ms. The position of the LE lead poles was classified as lateral in 44% and postero-lateral in 56%, basal in 28%, medial in 39% and apical in 34%. We evaluated 160 ED. The mean ED between the apical RV lead and the LV poles was significantly higher than the delay between septal RV lead and the LV poles [161±33ms vs 75±45ms ($p<0.001$)]. This difference remained significant in LV poles located in a lateral position (76±62 vs. 166±36ms; $p<0.001$) or in a postero-lateral position (74±30 vs. 157±31ms; $p<0.001$); the same ocurred for LV poles in a basal (99±62 vs. 179±24ms, $p<0.001$), mid (72±38 vs. 167±31ms, $p<0.001$) and apical location (57±24 vs. 140±32ms, $p<0.001$).
Conclusion: The LV lead position is an important determinant of the success of CRT, but is conditioned by anatomical and technical characteristics. The optimization of CRT may then depend on the positioning of RV lead. This study demonstrated that the apical (vs. septal) RV lead positioning presents higher ED in relation to LV lead, regardless of the latter position.